

REMARKS

Favorable reconsideration of this application, in light of the following discussion, is respectfully requested.

Claims 9, 10, 12-18, 21, 22, 24-28, and 30-37 are currently pending. No claims have been amended herewith.

In the outstanding Office Action, Claims 9, 10, 12, 13, 17, 18, 22, and 25, were rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent No. 6,380,518 to Shirakawa et al. (hereinafter “the ‘518 patent”); Claims 14, 24, and 25-27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘518 patent in view of U.S. Patent No. 3,750,620 to Eversteijn et al. (hereinafter “the ‘620 patent”); Claims 15, 16, 28, 30, 31, 36, and 37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication No. 2003/0070617 to Kim et al. (hereinafter “the ‘617 application”) in view of the ‘518 patent; and Claims 32-35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘518 patent in view of the ‘617 application.

REJECTION UNDER 35 U.S.C. § 102

Previously presented Claim 9 is directed to a processing apparatus for forming a film using atomic layer deposition (ALD), comprising:

a process chamber, an interior of the process chamber being maintained airproof so as to be ***exhausted to a vacuum***;

a gas supply section provided to said process chamber for supplying a predetermined gas into said process chamber; and

an exhaust opening provided to said process chamber so as to face said gas supply section and connected to exhaust means for exhausting the interior of said process chamber,

wherein said process chamber has a gas flow passage extending from said gas supply opening to said exhaust opening, and wherein said gas flow passage has a transverse cross-sectional area with at least a width that decreases in inverse proportion to a distance from said gas supply opening along said gas flow passage.

Regarding the rejection of Claim 9 under 35 U.S.C. § 102(a), the '518 patent is directed to a heat treatment apparatus and a substrate processing system incorporated in a resist coating/developing system for heating or cooling a substrate. In particular, a primary objective of the '518 patent is to reduce particles in a resist coater/developing system. The '518 patent discusses that, in the conventional technique, air is introduced from the backside of a wafer and evacuated from the upper side thereof, which results in dust and particles falling from around an exhaust opening to adhere to the wafer.¹ Accordingly, the '518 patent discusses a small heat treatment apparatus capable of heating a substrate uniformly while preventing particles from being attached to the substrate.² Further, the '518 patent discusses preventing non-uniform heating of the substrate without causing stagnation of the air on the substrate, and reducing the height of the treatment apparatus.³

However, the area on the '518 heat processing board through which air flows need not be a triangular shape to resolve the above problems, as it may also be a tetragon or circular shape. In the '518 patent, the triangular shape is merely an example. As apparent from the '518 drawings and disclosure, it is clear that the above problems may be solved regardless of whether the area on the heat processing board through which the air flows is a tetragon or circular shape.

Further, it is respectfully submitted that the '518 patent fails to disclose a process chamber, an interior of the process chamber being maintained airproof so as to be *exhausted to a vacuum*. With respect to the process chamber, the outstanding Office Action asserts that the recited process chamber is taught by the '518 patent because "[t]he apparatus of Shirakawa like any other processing apparatus is air proof (leak tight) and is exhausted to the vacuum (exhaust blower)."⁴ That is, the outstanding Office Action asserts that the '518

¹ See '518 patent, column 1, lines 27-35.

² Id. at column 1, lines 51-54.

³ Id. at column 5, lines 8-14.

⁴ See Office Action dated December 3, 2007, page 10.

patent discusses that an interior of a process chamber is exhausted *by* a vacuum (*i.e.*, the exhaust blower), rather than the interior of the process chamber being maintained airproof so as to be exhausted *to* a vacuum (*i.e.*, less than atmospheric pressure), as defined in Claim 9.

Moreover, it is respectfully submitted that the mere discussion of a process chamber does not make clear that a processing chamber, an interior of the process chamber being maintained airproof so as to be *exhausted to a vacuum*, is necessarily present in the ‘518 resist coating/developing system.⁵ Further, it is respectfully submitted that one of ordinary skill in the art would not apply vacuum sealing to the ‘518 resist coating/developing system, as a serious problem would result. In particular, photoresist contains a solvent for spin-coating. Therefore, when a wafer with a photoresist film is placed in a vacuum, *the solvent explosively vaporizes to destroy the resist film*. For example, it is noted that the ‘518 patent discusses that a “PREBAKE” is performed before exposure,⁶ and immediately after the spin coating, which would result in the problem discussed above.

Further, the implementation of vacuum sealing in the ‘518 resist coating/developing system is *not required and would unnecessarily increase costs*. For example, the ‘518 discussion of particles attaching to the substrate can be solved without vacuum sealing. Further, the ‘518 patent discusses the use of nitrogen gas or air,⁷ which is safe for the human body. Additionally, in practice, the ‘518 operation pressure is typically at 750 to 770 Torr, which is close to atmospheric pressure. Thus, vacuum sealing is not required.

Moreover, the ‘518 patent discusses that a chamber 52 of each of the heat treatment apparatuses has a ceiling 56a, a floor 56b, lateral walls 52a-52d, linear pipe 184, and air boards 187 and 188.⁸ However, when these lateral walls comprise three independent (*i.e.*, separate) parts, a vacuum-sealed apparatus cannot be formed. In particular, the ‘518 patent

⁵ See MPEP § 2112.

⁶ See ‘518 patent, column 8, lines 21-30.

⁷ Id. at column 9, lines 28-30.

⁸ Id. at column 8, lines 21-30 and column 18, 1-13.

does not disclose an O-ring, which is used for vacuum sealing, and that a side wall that is a one-piece cylindrical part is used for vacuum sealing with the O-ring. Further, the role of the '518 air boards 187 and 188 is guiding gas, not for sealing it. Similarly, the role of the '518 air boards 113 and 118, described at column 13, lines 49-60, is also not for sealing.

For a non-limiting example, the apparatus of the claimed invention forms a film such as a gate insulation film by use of ALD. Although based on similar fields of semiconductor manufacturing apparatuses, the '518 photoresist coating developing apparatus resides in a field that is completely different from the field of the claimed film deposition apparatus. The claimed invention is directed to improving throughput of a film deposition apparatus using ALD, *e.g.*, by decreasing the cross-sectional area of the flow path in inverse proportion to a distance from a gas opening to thereby suppress the occurrence of an interface layer.

Accordingly, Applicants respectfully traverse the rejection of Claim 9 (and all associated dependent claims) as being anticipated by the '518 patent.

REJECTION UNDER 35 U.S.C. § 103

Previously presented Claim 14 is directed to a processing apparatus for processing a substrate using atomic layer deposition (ALD), said processing apparatus comprising:

a process chamber having a bottom wall configured to support the substrate, an interior of the process chamber being maintained airproof so as to be *exhausted to a vacuum*;

a gas supply opening provided to said process chamber and connected to gas supply means for alternately supplying plural species of gases into said process chamber; and

an exhaust opening provided to said process chamber and connected to exhaust means for exhausting the interior of said process chamber,

wherein said process chamber has a cross-section that has an approximately triangular shape as seen from a direction approximately perpendicular to said bottom wall.

Regarding the rejection of Claim 14 under 35 U.S.C. § 103(a), the outstanding Office Action asserts that the '518 patent discusses all the limitations of Claim 14 except a chamber

having a bottom wall configured to support the substrate.⁹ Rather, the outstanding Office Action cites the '620 patent for such a teaching.

However, as discussed above, the '518 patent fails to disclose the process chamber recited in Claim 9. Thus, the '518 patent fails to disclose the process chamber having a bottom wall configured to support the substrate, an interior of the process chamber being maintained airproof so as to be *exhausted to a vacuum*, recited in Claim 14. Further, it is respectfully that the '620 patent fails to remedy the deficiencies of the '518 patent, as discussed above.

Thus, no matter how the teachings of the '518 and '620 patents are combined, the combination does not teach or suggest a process chamber having a bottom wall configured to support the substrate, an interior of the process chamber being maintained airproof so as to be *exhausted to a vacuum*.

Accordingly, Applicants respectfully traverse the rejection of Claim 14 as being unpatentable over the '518 and '620 patents.

Previously presented Claim 15 is directed to a method for processing a substrate placed in a process chamber, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum, using atomic layer deposition (ALD), by alternately supplying plural species of gases into said process chamber from a gas supply opening and switching atmosphere in said process chamber, said method comprising:

supplying, alternately, each of said plural species of gases into said process chamber from said gas supply opening; and

causing each of said plural species of gases supplied in said gas supplying to flow in said process chamber in a manner that said gas flows along a gas flow passage having a transverse cross-sectional area with at least a width that decreases in inverse proportion to a distance from said gas supply opening.

⁹ See Office Action dated December 3, 2007, page 4.

Regarding the rejection of Claim 15 under 35 U.S.C. § 103(a), the '617 application is directed to an apparatus for and process of depositing a thin film on a wafer through atomic layer deposition using remote plasma. As acknowledged by the outstanding Office Action, the '617 application fails to disclose "a process chamber having a transverse cross-sectional area with at least a width that decreases in inverse proportion to a distance from said gas supply opening."¹⁰ Rather, the outstanding Office Action relies on the '518 patent for such a teaching.

However, it is respectfully submitted that the '518 patent is *non-analogous prior art*, which cannot be relied upon under 35 U.S.C. § 103, as the '518 patent is not in the same field of Applicants' endeavor, or reasonably pertinent to the particular problem with which Applicants' was concerned.¹¹ The claimed invention forms a film, *e.g.*, a gate insulation film, by use of ALD. Although based on the field of semiconductor manufacturing apparatuses, the '518 photoresist coating developing apparatus resides in a field that is completely different from the field of the claimed film deposition apparatus. Thus, it is respectfully submitted that the '518 patent is not in the same field of Applicants' endeavor.

Further, it is respectfully submitted that the '518 patent is not reasonably pertinent to the particular problem with which Applicants' was concerned. The claimed invention is directed to improving throughput of a film deposition apparatus using ALD, *e.g.*, by decreasing the cross-sectional area of the flow path in inverse proportion to a distance from a gas supply opening to thereby suppress the occurrence of an interface layer. The '518 patent, however, is directed to a photoresist coater/developer system for preventing particle adherence, preventing uneven heating, and providing a heat processing apparatus that can be downsized in the vertical dimension, as discussed above. Further, as discussed above, the '518 patent discusses various forms that include tetragon and circular shapes, and the '518

¹⁰ See, Office Action dated December 3, 2007, page 6.

¹¹ See MPEP § 2141.01(a).

resist coating/developing system is not vacuum sealed. Thus, it is respectfully submitted that the '518 patent is not reasonably pertinent to improving throughput of a film deposition apparatus using ALD with which Applicants' was concerned.

Hence, it is respectfully submitted that a person having ordinary skill in the art would not have looked to the '518 patent, to remedy the deficiencies of the '617 application, as the '518 patent is non-analogous art under MPEP § 2141.01(a). A person having ordinary skill in the art would not have conceived, relying upon the teachings of the '518 patent, an ALD-based film deposition apparatus that alternately supplies a plurality of kinds of gases, the flow path including the neighborhood of the wafer being approximately a triangular shape, having a width decreasing in inverse proportion to the distance from the gas supply hole toward the exhaustion hole.

Accordingly, Applicants respectfully traverse the rejection of Claim 15 (and all associated dependent claims) as being unpatentable over the '617 application and the '518 patent.

Regarding the rejections of dependent Claims 24-27 under 35 U.S.C. § 103(a), it is respectfully submitted that the '620 patent fails to remedy the deficiencies of the '518 patent, as discussed above. Accordingly, Applicants respectfully traverse the rejections of dependent Claims 24-27 as being unpatentable over the '518 and '620 patents.

CONCLUSION

Thus, it is respectfully submitted that independent Claims 9, 14, and 15 (and all associated dependent claims) patentably define over any proper combination of the '518 patent, the '620 patent, and the '617 application.

Consequently, in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be

Application No. 10/516,311
Reply to Office Action of December 3, 2007

in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

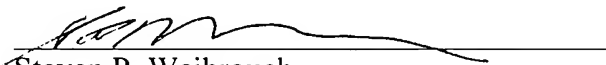
Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Customer Number

22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/07)


Steven P. Weihrouch
Attorney of Record
Registration No. 32,829

Johnny Ma
Registration No. 59,976

I:\ATTY\JM\26's\263194US\263194US-AM DUE 3-3-08.DOC